Otsego Lake

Otsego County; T29N & 30N, R3W, Sections 4, 5, 8, 20, 21, 29, 28, 32 and 33
Au Sable River Watershed; last surveyed in 2007

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Environment

Otsego Lake occupies 1,972 acres and is located in southwestern Otsego County approximately 3 miles south of the city of Gaylord, within the north central area of the Lower Peninsula. This natural lake was formed during the retreat of the last glacial period some 11,000 years ago. Lake elevation is approximately 1,273 feet above sea level with a drainage area of 6,971 acres. The hydrologic retention time (the amount of time a drop of water takes to pass through the watershed) is 3.6 years. There are no natural inlets or outlets except that in 1972 an outlet tube and control structure was installed by the lake association connecting the lake with the North Branch Au Sable River to lower excessively high lake levels. During that process a legal lake level was established with a maximum level at 1,273.5 feet and minimum level at 1,273.0 feet above mean sea level (MSL).

The country surrounding Otsego Lake is hilly, mostly forested with glacially deposited soils composed of sands and gravels. The lake is located on the south slope of the high moraine ridge in the north central Lower Peninsula that forms the headwaters of five watersheds including the Charlevoix, Torch, Cheboygan, Thunder Bay and Au Sable watersheds. Wetlands are located on the northwest and south shores. The watershed is made up of a mixture of private ownership and Mackinaw State Forest lands. Predominant land uses in the watershed include residential and recreational with the cover type primarily forested. Approximately 90 percent of the lakeshore of Otsego Lake is developed with homes and cottages.

Otsego Lake is a relatively shallow lake with a maximum depth of 23 feet and an average depth of 9.8 feet and approximately 85% of the lake's area is shallower than 15 feet (Figure 1). Aquatic vegetation is abundant through much of the lake and is composed of chara, potamogeton, milfoil and lily pads. Bottom types in the shoal area are composed of sand, gravel and pulpy peat, with pulpy peat found throughout the varying water depths. During the late 1800s and early 1900s, the lake was used extensively by the logging industry. Four sawmills were known to have been located on the lake and it was common practice at that time to dispose of the mill's wood waste into the lake. Submerged deadheads, slab wood and decomposed sawdust are still observed today. Recent measurements of bottom sediments indicate up to 23 feet of organic materials are found in the south basin leftover from historical milling practices.

Water quality conditions were surveyed on August 12, 2008. The water color was generally clear with a light algal bloom and the Secchi disc reading was 9 feet. Within the water column, pH ranged from 8.3 to 7.4 and dissolved oxygen ranged from to 9.78 ppm (surface) to 6.24 ppm (bottom); all values within the normal range. Water temperature ranged from 69.3 ºF (surface) to 66.7 ºF (bottom at 20 feet), with no stratification or thermocline present. Similar water quality samples were conducted on August 8, 2007 with the Secchi disc reading at 9.5 feet, pH at 8.4, and alkalinity at 63 ppm and water temperature at 77 ºF.

Historic water quality data was collected on July 11, 1949. The water color was clear with a light algal bloom and the Secchi disc reading was 12 feet. Within the water column, pH ranged from 7.6 (surface) to 7.8 (bottom), dissolved oxygen ranged from 8.2 (surface) to 8.1 (bottom), and alkalinity was 70ppm. Water temperature ranged from 76 ºF (surface) to 72 ºF at 17 feet. These data suggest that slight eutrophication may be occurring through the addition of excessive nutrients.

Otsego Lake is a popular recreational lake, both summer and winter. There are two public campgrounds on Otsego Lake: Otsego Lake State Park and Otsego County Park. The Otsego Lake State Park receives on average 107,000 visitors while the Otsego County Park has an average annual campsite use of 36,000 guests. Each park provides boat launching and swimming facilities. In addition, there are several rental cottages and cabins around the lake. Otsego Lake also receives heavy summer and winter fishing pressure.

History

Otsego Lake plays an important role in the area's historic logging era in the late 1800's resulting in significant impacts to the lake that remain to the present day. In 1873 a railroad was extended to the north end of the lake bringing along the construction and operation of four sawmills on the shore of the lake. The surrounding timber was harvested during the winter and skidded onto the ice where the lake was used to store the wood until processing at the mills. Large quantities of timber waste (slab wood, bark and sawdust) were generated by these mills, most of which were disposed of in the lake. These waste materials have decomposed resulting in excessive silt deposits in the north basin, west shore and south basin.

Early fisheries management was directed at fish stocking. Stocking records indicate five species of fish were stocked in Otsego Lake in the early years, 1933 through 1945, including smallmouth bass, largemouth bass, walleye, yellow perch and bluegill. This stocking program was discontinued due to a change in agency policy supported by investigations showing that stocking of warm water species (perch, bass and sunfishes) is not necessary where they are already established as these species have the ability to sustain their population through natural reproduction. Northern pike were stocked in 1953, 1954, 1959, 1960 and 1961 totaling 1,369 adults and 1,223 fingerlings. Beginning in 1966 a 31 acre northern pike rearing marsh was enhanced on the northwest tip of the lake. A low head berm and spillway was constructed to allow water to be pumped from the lake into the marsh creating flooded vegetation for spawning and juvenile rearing. The marsh is flooded each year at ice out with adult northern pike captured during the spawning run and transferred into the marsh to spawn. The fingerlings are then released approximately four weeks later. Tiger muskellunge, a hybrid between northern pike and northern muskellunge, were stocked between 1976 and 1991. Lake sturgeon were stocked periodically beginning in 1982. Walleye fry and spring fingerling plants were resumed in 1991 (Table 1).

Otsego Lake has a history of varying lake levels, with high lake levels being documented in 1913, 1960 and most recently the winter of 1970-71. A contributing factor to this is that the lake has no natural inlet or outlet to stabilize lake levels. Historically there is evidence of a former connection to the east into the North Branch Au Sable River (at some high historic lake level). Riparian property owner concern elevated during this last high water period due to lake front flooding, shoreline erosion and septic field inundation. A plan was initiated in 1971 to install a lake level control structure that

would drain off excess lake water into the headwaters of the North Branch Au Sable River which is located one and one-half miles to the east. A legal lake level was established in 1972 through a court action which set a maximum level at 1,273.5 MSL, at which point lake water would be drained out through the newly constructed diversion pipe. Drainage first began on December 19, 1972. Legal challenges within the court system were levied to insure the lake discharges into the North Branch Au Sable River would not impair the riverine environments or its fisheries communities.

Historical fisheries surveys were first conducted in 1927 by J. Metzelaar. This survey was composed of shoreline seinings from several points along the shoreline. Important game fish at this time included northern pike, smallmouth bass, yellow perch and bluegill. Field notes from this survey included "pike fishing reported excellent. Smallmouth bass fair. Bluegills generally poor, occasional big ones and bullheads abundant. We seined up in one haul about 500 young perch and 60 smallmouth bass. Hardly any darters or shiners and a few suckers." Informal creel surveys (random checks) were conducted periodically by area game wardens during the following years from 1928 through 1948. Northern pike were the most common species in the catch followed by yellow perch, bluegill and smallmouth bass. Data collected during the period when spearing was allowed (1908-1932) show that on average one pike was harvested per three hours of spearing. A check of 190 northern pike harvested by anglers during the winter of 1934-35 had an average length of 20.3 inches. Other creel data collected in January, May and June 1949 (no spearing permitted) show that on average for those months one pike was harvested per 3 hours of angling. For the month of January only, one pike was harvested for every two hours of effort.

The first extensive biological survey was conducted by the Michigan Department of Conservation (MDOC) from June 17 through July 16, 1949 (Taube, 1950). They found the waters of Otsego Lake moderately hard (pH 7.6 to 8.1 and alkalinity 70ppm), aquatic plants generally abundant with the submergent predominating. Emergent vegetation occurs at scattered locations along the shore and consists chiefly of rushes. The floating type of vegetation is sparse, although there are beds of yellow and white pond lilies which are confined mostly to the north end of the lake. Floating-leaf potamogeton is found at a number of places in the central part of the lake. A narrow leaved pondweed is especially common in depths from 10 to 15 feet. Other submergents include chara and water star grass.

The bottom sediments of much of the shallows near shore consist of sand. Gravel is mixed with sand at several locations. In some places pulpy peat extends right up to shore; pulpy peat is the principal bottom sediment at depths exceeding five feet. Numerous cottages and dwellings surround the lake with three hotels, 45 resorts and around 25 boat liveries. Otsego Lake State Park and a county bathing beach are located on the east side with a county park on the west side. Fishing affords one of its greatest attractions, although boating and swimming are important too.

Principle game fish present include northern pike, largemouth and smallmouth bass, bluegill, pumpkinseed sunfish, rock bass and yellow perch (Table 2). Growth analysis showed bluegill, rock bass and yellow perch to be developing at a rate below state average mean length at age; except for several year classes of largemouth bass and pumpkinseed sunfish exhibiting average growth. Coarse fish included common white sucker, black bullhead and yellow bullhead. Forage fish included bluntnose minnow, banded killifish, blacknose shiner, mimic shiner, common shiner, river chub, hornyhead chub, mudminnow, Iowa darter and Johnny darter.

During this survey, considerable interest was placed on evaluating the status of northern pike as they were the favored game fish by local anglers. The average length of 120 northern pike collected by netting was 21 inches with an average weight of 2.5 pounds (Table 3). The largest northern pike captured was 30.4 inches and weighed 5.75 pounds. Stomach analysis showed they feed mainly on perch with centrarchids (bluegills, sunfish, bass, etc.,) ranking second. A winter spearing ban was initialed in 1936 to protect the pike population from over-harvest. Attempts were made periodically to remove the spearing ban and it was only relaxed for one winter around 1950. It was thought that conservation (protection) had more influence in maintaining the northern pike fishery than does the ban on spearing.

The next fish community survey was conducted by MDOC in late June and early July, 1958. They used various mesh size gillnets and a bag seine with gillnet and seining sites similar to the 1949 survey. It was noted that the lake level was low at this time. This survey effort captured two northern pike (30.0" and 33.8"), 194 yellow perch (4.0" to 12.8"), seven smallmouth bass (8.4" to 13.2"), 22 largemouth bass (4.4" to 17.8"), 58 bluegill (4.5" to 6.4"), 92 pumpkinseed sunfish (4.4" to 8.0"), 12 rock bass (4.6" to 7.5"), 14 white sucker (12.7" to 18.8"), five black bullhead (8.9" to 12.4") and one yellow bullhead (9.7").

A seine survey was conducted on October 22, 1962 by MDOC. This catch was composed of 639 yellow perch (4.7" to 8.7"), 363 bluegill (6.0" to 9.3"), 104 rock bass (3.5" to 8.4"), 85 pumpkinseed sunfish (3.6" to 8.2"), 10 largemouth bass (7.1" to 16.7"), eight smallmouth bass (10.0" to 16.4"), 12 white sucker (5.8" to 15.0"), three northern pike (25.3" to 18.3") and one black crappie (10.9"). This was the first report of black crappie in Otsego Lake. It was noted that low water levels and the presence of large quantities of slab wood made seining difficult.

A series of seine efforts were conducted May 28 through June 5, 1962 by MDOC. This effort captured similar species to the previous surveys including bluegill, pumpkinseed sunfish, rock bass, yellow perch, northern pike, largemouth bass, smallmouth bass, white sucker and common shiner. Growth rates were determined for yellow perch and northern pike. Yellow perch were present in four year classes, II, III, VI and VIII with overall growth slightly below the state average at age. One year class of northern pike was captured (age I) with the growth rate below state average. It was also noted that because of abundant snags on the bottom, seining should no longer be used to sample fish.

Operation of the northern pike rearing marsh allowed for annual monitoring of the adult northern pike spawning run. Northern pike were typically trapped at the outlet of the rearing marsh and then transferred into the marsh to complete spawning. During the early years, 1966 through 1969, total numbers of northern pike captured were recorded along with the size and age structure of fish in the spawning run. There were typically six year classes of northern pike present (ages I through VI) with the majority age III and younger. Sizes ranged from 13.0 inches to 40.0 inches. Growth rates were determined to range from 4.9 inches to 6.4 inches above state average.

A mark and recapture northern pike population estimate was conducted in 1969. This study coincided with the rearing marsh operation to determine the status of the northern pike population in the lake and verify whether there is biological justification to maintain the northern pike spearing ban. Four hundred and ninety northern pike were tagged during marsh operations (April 4 through 15, 1969) with

numbered dart tags. Eighty eight of these fish were placed into the marsh with the remaining 402 released back into the lake. Recapture operations were conducted from May 27 to June 5 through 50 trap and three gill net lifts around the entire lake. One hundred eighty nine northern pike were captured with 24 tag recoveries resulting in a population of 3,166 northern pike (1.6 fish per acre). It was recommended to maintain the northern pike spearing ban due to a low population and a previously demonstrated fast growing though young population. It was also recommended that future studies be conducted to determine if the spearing ban does improve the status of the northern pike population.

In addition to the northern pike population study, size and growth data was collected from all other species captured during the netting effort. Largemouth bass and smallmouth bass were numerous with good catches of bluegill, pumpkinseed sunfish, rock bass and black crappie. Only one yellow perch was captured. Growth analysis indicated all species were growing at or slightly above state average with the exception of smallmouth bass which was growing slightly below state average.

The Michigan Department of Natural Resources initiated a state wide tiger muskellunge stocking program in 1976. Tiger muskellunge is a hybrid cross between northern pike and northern muskellunge. The goal of the tiger muskellunge program was to create and maintain a low density top predator that would help balance prey fish populations (primarily sucker populations) in addition to providing a fishery for a large game fish. Otsego Lake was selected to receive plants of tiger muskellunge with the first three plants of spring fingerling going into the rearing marsh and subsequent plants of fall fingerlings direct lake plants (Table 1). The marsh rearing efforts were not considered very successful. The direct lake plants of fall fingerlings were successful in establishing a non reproducing population due to the hybrid being sterile.

This musky management action did raise concern with local anglers. It was feared that the tiger musky would over populate the lake and reduce game fish numbers by their "feared" voracious appetite. A series of fisheries surveys were directed at evaluating the status of the tiger muskellunge population and its interactions with the fish community. These trap nets, fyke net and gill net surveys were conducted in the falls of 1978, 1980, spring 1981, and fall 1983. Over 195 tiger muskellunge were sampled during this period with fish up to 34 inches. All stocked year classes were represented in the sample but it was noted that the majority of musky present were from the fall fingerling plants and not the rearing marsh releases. Stomach analysis indicated that yellow perch were the most common species eaten by muskellunge. One bass and one minnow were noted but it was suspected that the trapped muskellunge fed on fish contained in the net and biased the results. MDNR Fisheries Division discontinued its tiger muskellunge rearing program in 1991.

These surveys also revealed a good population of game fish including black crappie, bluegill smallmouth bass and pumpkinseed sunfish with lesser numbers of yellow perch, largemouth bass and northern pike. White sucker and bullhead were also common. Growths rates varied but continued to be slightly below state average to above state average. Angler reports indicated good fisheries for black crappie, bluegill and tiger muskellunge with yellow perch running small.

Walleye were first introduced in Otsego Lake in 1933 through the planting of 600,000 fry (Table 1). Similar fry plants ranging from 500,000 to 1,000,000 were conducted annually through 1940. These fry plants established a very low walleye population with few angler catches reported. Following fisheries surveys failed to produce any walleye catches indicating that the walleye population was not

reproducing. Walleye stocking was resumed in 1991 primarily through fry plants with a gradual switch to spring fingerlings beginning in 1994. This switch was due to improvements with walleye rearing pond techniques that allowed the production of large numbers of fingerlings which survived with much higher percentages. Eventually walleye plants consisted mainly of spring fingerlings with an occational fry plant.

Another species introduction began in 1982 with the stocking of 235 spring fingerling lake sturgeon (Table 1). These plants were designed to act as a comparison to similar plants being conducted on Black Lake in Cheboygan County. Additional plants were also made in 1982, 1991, 1992, 1993, 2002 and 2006. A hook and line fishery for lake sturgeon started to develop in the early 1990's. To assist in monitoring sturgeon fishing effort and catch a mandatory registration program was initiated in 1991. One hundred-nine lake sturgeon have been registered in the harvest as of 2010 (Table 4). With many anglers increasingly practicing catch and release fishing, sturgeon harvest does not give a true measure of the value of this fishery.

Nine fisheries surveys were conducted from 1991 through 2002 to monitor the fish community and stocking success for walleye, lake sturgeon and northern pike. Two of these were general fish community surveys (May 1994 and May 2001) utilizing trap nets, fyke nets and gill nets. Both surveys found diverse fish populations with good numbers of walleye, smallmouth bass, largemouth bass, black crappie, bluegill and northern pike and lesser numbers of yellow perch, tiger muskellunge and lake sturgeon. Growth rates remained at or near state average, similar to past surveys. Associated angler reports indicated that walleye catch rates were improving, to a level that the lake was now becoming a "destination" for walleye anglers. Northern pike were still an important component of the winter fishery and catches of lake sturgeon were increasing (Table 4). The remaining seven surveys were fall electro fishing efforts directed at evaluating survival or natural year class strength of walleye and lake sturgeon. These shocking efforts were conducted in September 1991, 1993, 1994, 1997, 1998, and 2002. Catch rates for young-of-year walleye ranged from 0 to 161 fish per shocking effort equating to 0 to 7.5 fall fingerling per acre (Table 5) (Serns, 1982). In 2002 all stocked walleye fingerling were chemically marked and all fall fingerling walleye sample from the fall electro fishing catch were marked indicating that they were all from hatchery origin with no evidence of natural reproduction.

Nearly all of these surveys indicated a large population of large white sucker. Otsego Lake's large size predatory fish community is small, lacking the ability to utilize or reduce these numbers. Tiger muskellunge were no longer considered present with the discontinuation of stocking in 1991. To address this issue, northern muskellunge were prescribed for stocking and the first fall fingerling plant was introduced in September 2006 with a follow up fall plant in 2008. The goal of this management action is to diversify the predator base to utilize the abundance of large white sucker and provide an additional angling opportunity.

Current Status

The most recent fishery survey was conducted from May 21 thru May 24 and September 19, 2007 by the DNR Fisheries Division using Status and Trends protocol. Survey effort was directed at collecting fish community data by targeting all species and all sizes of fish, and collecting limnological data. Total survey effort included 21 trap net lifts, 18 standard fyke net lifts, 11 gill net lifts, 4 max-min fyke net lifts, 2 seine hauls, 45 minutes of standard boom shocking (conducted during the night of

September 19th). Part of this sampling effort included collecting 60 bluntnose minnows, 60 rock bass and 60 yellow perch for disease testing, specifically Viral Hemorrhagic Septicemia (VHS). These fish were sent to Michigan State University and test results did not detect the presence of VHA. Reports of yellow perch with abnormally appearing gills were received this year but no abnormalities were noted in this survey.

The total catch of the survey resulted in the capture of 1,973 individual fish from 19 different species (Table 6). The most common species by number were yellow perch (750 fish) and the most common by weight were white suckers (820 pounds). Other game fish captured include rock bass (325), walleye (116), bluegill (87), smallmouth bass (33), northern pike (29), largemouth bass (12), black crappie (5) and lake sturgeon (4). Rough fish included white sucker (350), brown bullhead (84), yellow bullhead (2) and greater redhorse (1). Forage minnows included bluntnose minnows (124), Johnny darter (10), emerald shiner (6) and common shiner (1).

Age distribution and growth rates for the various game fish species were determined from the analysis of scales collected from the fish (scales and spines were collected from walleye). Scales were collected from 10 fish per each inch group per species. Multiple age groups were noted for the various species and associated growth rates were near state average (pumpkinseed sunfish, rock bass, smallmouth bass and yellow perch) to well above state average (northern pike, bluegill and walleye) (Table 7). Due to the low numbers captured of largemouth bass and black crappie, the "mean growth index" could not be calculated but indications are that these populations are growing above state average.

Water quality data was collected by U. S. Geological Survey on April 16 and August 8, 2007. Ph ranged from 7.9 to 8.4, Secchi disk readings were from 2.9 m to 4.1 m, dissolved oxygen ranged from 7.6 mg/l to 12.6 mg/l, dissolved phosphorus ranged from 0.011 mg/l to 0.013 mg/l and chlorophyll a ranged from 1.9 ug/l to 3.0 ug/l. No thermal stratification was present in the August sampling. Water quality parameters were consistent with other area lakes. Aquatic vegetation was also sampled by the U.S. Geological Survey on August 8, 2007. Total lake vegetation coverage was assessed at 50% of the lake area with 0% of littoral area classified as impaired, where no recreational uses are impacted by aquatic plants. Plants identified as present included (submergents): chara, coontail, elodea, milfoil, Eurasian milfoil, najas, broad-leaf pondweed, medium-leaf pondweed, nur-leafed pondweed, curly-leaf pondweed, bladderwort and wild-celery; and (floating or emergents): duckweed, yellow pond lilies, white pond lilies, rushes, sedges, cattails, pickerelweed and purple loosestrife.

Analysis and Discussion

Otsego Lake has and continues to hold a diverse cool and warm water fish community that periodically leans in abundance from one species to another. Some of these shifts were a result of natural influences and some have been through hatchery introduction. Natural swings in abundance have been noted in yellow perch, bluegill, smallmouth bass, largemouth bass and northern pike. Early attempts to bolster yellow perch, bluegill, smallmouth bass and largemouth bass through stocking had little influence on abundance and it was noted that these populations could sustain themselves through natural reproduction.

Northern pike have always been a very important component of the sport fishery. It appears that this population had highs and lows with management actions directed at some stocking and progressively more restrictive harvest regulations (higher size limits, lower creel limits and a spearing ban). Natural reproduction sustained the population through the late 1950s. Higher recruitment rates were associated with periods of high lake levels which allowed better access to the spawning marshes on the north and south areas of the lake. These high water years also improved rearing habitat in the marshes, allowing more fingerlings to be produced. In the late 1950s, dredging and filling around these marshes for residential development began to compromise these valuable northern pike spawning habitats and negatively affected the overall northern pike population. Management actions were taken to protect the remaining riparian wetlands and to construct a water level control structure on the north marsh to assure adequate northern pike spawning habitat regardless of the lake level. To further encourage pike spawning, northern pike captured during the spring are transferred into the north marsh.

Walleye have always been a desired game fish in Michigan waters with numerous fry introductions in the 1930s and 1940s. These early fry stocking events in Otsego Lake produced a marginal fishery that slowly declined after stocking was discontinued in 1940. It was apparent that walleyes were not able to successfully reproduce, most likely due to the lack of suitable spawning substrate. Walleye fry and spring fingerlings were stocked again in 1991. This management action was at the request of anglers wanting a walleye fishery in the area and also to resolve a management need for a top predator to control the yellow perch population. These recent stocking events have been successful in establishing a walleye population, providing a good sport fishery and managing yellow perch.

Lake sturgeon management was initiated in 1982 as an evaluation control for a stocking research project on Black and Mullet Lakes in Cheboygan County. These introductions have resulted in a lake sturgeon population that is gaining prominence and able to sustain some harvest. Comparison of the historic stocking numbers (Table 1) with the reported harvest (Table 4) provides managers insight into the expected harvest fishery that may be produced with varying stocking numbers through time. No natural reproduction has been detected to date and there is an assumed lack of suitable spawning habitat. Management of lake sturgeon adds to the diversity of the fish community and provides additional angling opportunity.

Two attempts have been made to establish muskellunge as a top predator to reduce white sucker numbers and provide a large game fish. The first attempt involved stocking hybrid tiger muskellunge from 1976 through 1991. These stocking efforts established a population, but with the discontinuation of the tiger muskellunge rearing program at the state level, the population disappeared after time with no reproduction as the hybrid is considered sterile. The second attempt began in 2006 with the stocking of northern muskellunge with similar management objectives as the tiger muskellunge. Unlike the tiger muskellunge it is anticipated that northern muskellunge will reproduce since northern muskellunge spawn over mats of chara and this type of vegetation is present in Otsego Lake.

Individual summations for game fish are as follows:

Yellow perch - good numbers present of various ages (0 through 7). Average size is small (3.2 in) due to strong year classes of young of year (YOY) and age 1 and 2. Some large perch are present through (8 to 11 in). The high densities of YOY perch are providing forage for walleye. Growth is slightly below state average (-0.6 in).

Rock bass - good numbers present of various ages groups (1 though 10). Size distribution is average with fish ranging 3 to 12 in with an average of 7.8 in. The mean growth index is +1.2 in indicating overall growth is above state average.

Walleye - excellent numbers present from a wide range of age groups (1 through 13). Size distribution is excellent ranging from 13- 26 in with an average of 19.5 in. The mean growth index is well above state average at +2.1 in. The lack of YOY (age 0) indicates natural reproduction is very low and stocking is needed to sustain the population.

Bluegill - fair numbers present from a wide range of age groups (2 through 10). Size distribution favors smaller fish with an average size of 5.6 in but there are fair numbers of larger fish in the 8 to 10 in range. There is a strong year class of age 4 fish (7.5 to 8.7 in) present which should provide a good fishery in the next few years. Growth rates are well above the state average at +2.2 in.

Smallmouth bass - fair numbers present from a wide range of age groups (1 though 10) with the younger age groups more common. Growth rates are good with the mean growth index 0.9 in above state average. This appears to be a developing population and should improve in future years.

Northern pike - good numbers present from a population of young to middle-aged fish (2 through 7). There appears to be a lack of older age groups with only one age 11 captured. Northern pike are capable of living in excess of ten years and trophy size fish are typically older than twelve years. The lack of good numbers of large fish is most likely due to over harvest as growth rates are excellent with the mean growth index 4.7 in above state average. The strong age 2 group was hatched in the spring of 2004 and coincides with improvements made to the rearing marsh located at the northeast corner of the lake. These improvements allowed more water to be added to the marsh creating more area of flooded vegetation. In addition, more adult females were transferred into the marsh to spawn than in past years. It appears that these efforts may have contributed to the production of a strong year class of northern pike and should be continued.

Largemouth bass - survey results tend to indicate a small population with good size distribution (10.9 to 20.1 in). Relatively few fish were captured (N=12) but they appear to be growing well.

Black crappie - survey results tend to indicate a small population with only 5 fish captured. This small number of individuals captured may, in part, result from the difficulty in effectively sampling the typically clumped distribution of crappie.

Lake sturgeon - four lake sturgeon were captured during this survey and ranged in size from 28 to 30 in. One of these fish was aged by the cross section of a pectoral fin spine and determined to be age 6 representing a group of fish that were hatched in 2001. This fish was most likely the result of a 2002 stocking of 26 yearling fish that originated from stock collected from Lake St. Clair.

Rough fish - five species of rough fish were identified in the survey (white sucker, brown bullhead, yellow bullhead, carp and greater redhorse). This is the first collection of carp from the lake. White sucker numbers and biomass are high, but the overall rough fish population appears to be in balance with the total fish community. White sucker reproduction can be considered an important component

of the forage base and most likely contributes to the good growth rates observed in the predatory species such as northern pike and walleye. The large size range of bullheads could also lend to additional sport angling opportunities as some anglers enjoy angling for them along with being good table fare.

Forage minnows - four species of minnows were captured in low numbers (bluntnose minnows, Johnny darter, emerald shiner and common shiner). It is most likely the forage base is dependent on YOY yellow perch and white sucker. It is apparent the forage base is adequate due to the high growth rates observed for the predatory fish.

A significant limiting factor for the lake ecosystem is the excessive silt accumulations in the northern, west central and southern basins of the lake. These silt residues are from historic sawmill operations which disposed their waste wood products (saw dust, bark and slab wood) by dumping them into the lake. Sediment cores were collected by the lake property owners association in February 2006. It was noted that areas of silt deposition exceeded 15 feet with an average of 5 feet in depth. These areas of silt accumulation provide little habitat for many plant and fish species and create areas that are essentially biological deserts. Removal of this industrial waste could restore biological function to nearly 1,000 acres of lake.

Exotic species introduction has the potential to interfere with natural lake processes and biological function. Curly leaf pond weed and Eurasian water milfoil have recently been introduced into the lake. Both of these plant species have the potential to displace native vegetation and grow into densities that can impair lake usage and change fish species composition and size structure. Control measures are available through biological means (weevils) or chemical (herbicides) but would be very costly with a lake of this size. The other exotic species of immediate concern is the zebra mussel, but none have been identified in the lake to date.

Continued riparian habitat alteration and loss will continue to impair the lake environment and its fish community. Removal of native riparian vegetation, lawn fertilization and improperly functioning septic systems will cause advanced eutrophication. This can lead to excessive algae blooms and plant growth in the lake and impair various uses such as boating, swimming and fishing. Wetland draining or filling will reduce critical habits for certain species of fish including northern pike. These activities can reduce the production of forage fishes that support growth of game fishes or also further reduce the spawning potential for northern pike resulting in greater dependency on operation of the rearing mar

Management Direction

Otsego Lake contains a very diverse and stable fish community that is based on both natural reproduction and stocking. Natural reproduction is based on maintaining or improving existing conditions within and around the lake that support required habitats for successful spawning and nursery areas. Natural reproduction sustains yellow perch, rock bass, bluegill, smallmouth bass and black crappie. Northern pike numbers are sustained by natural reproduction with assistance from the rearing marsh operations. Walleye, muskellunge and lake sturgeon populations are dependent on stocking. Growth rates are good for all species indicating the biological capacity of the lake has not been exceeded and the lake is quite productive. The high density of large white suckers indicates that a niche is available that would allow an increase in predators such as northern pike or muskellunge.

Managing for additional top predators would be of benefit to other game fish because it would reduce the number of white suckers that are currently competing with them for forage resources. Additional top predators would also add diversity to the fishery and make it more attractive to anglers.

1) Environment and population monitoring:

The Otsego Lake aquatic environment is complex with various facets interrelated. Riparian development, lake levels, invasive species, excessive nutrients, aquatic plants, industrial waste and angling activity all have potential influence on the fish community. A monitoring program should be developed to monitor the status of each of these aspects. The fish community can be a good indicator of the health of the lake. Fish community surveys should be conducted at periodic intervals to evaluate fisheries management activities and allow for any needed changes in management actions.

2) Habitat protection and restoration:

Riparian zones are important to the lake's aquatic communities. Natural vegetative buffers protect shorelines from erosion, provide cover for juvenile fish, allow woody debris to add to the lake naturally and require little maintenance. It is recommended that natural shoreline vegetation not be removed and that it be restored to areas where it has been removed. Riparian wetlands are also important to the health of the lake. These wetlands filter sediments and pollutants from entering the lake. They are also critical habitats for many forms of aquatic life. Northern pike in particular depend on spring time flooded vegetation found in many of these riparian wetlands for spawning substrate and nursery habitat for juvenile fish. Riparian wetlands need to be protected from activities that may impair these biological functions.

Excessive sediment accumulations in vast areas of the lake have resulted from historic sawmill waste disposal. A feasibility study should be conducted to evaluate the potential to remove this industrial waste. Removal of this waste material could potentially restore biological function to nearly half of the lake area, or approximately 1,000 acres.

It appears that spawning habitat for walleyes is limited due to the lack of natural recruitment noted in fall electrofishing surveys. A feasibility study should be conducted to evaluate the potential for constructing rock reefs for walleye spawning. Other species would benefit from this action including smallmouth bass and rock bass. Potential areas would include firm bottomlands that have little silt deposition and receive wave action from prevailing winds.

There is a noted lack of shoreline woody debris due to extensive shoreline development. Historic practices have eliminated many of shoreline trees, especially trees that have fallen into the shoreline waters. These fallen trees provide critical habitat to various species and their life stages. Protection should be given for existing shoreline trees so that they may grow, mature, die and fall into the lake. Once in the lake they should be restricted from removal. Restoration of large woody debris should be considered through the placement or retention of shore line tree drops and placement of offshore sunken tree bundles.

It appears that invasive aquatic vegetation may be increasing in densities that may impair uses of the lake including boating, swimming and fishing. In the event that conditions deteriorate to the point

where a control program is considered, proper planning should be conducted to identify the problem and develop an appropriate treatment plan that is weighted toward biological control rather than chemical.

3) Fish stocking:

Predator and prey fish relationships are critical to the health of the fish community and the angling opportunity that it provides. Present habitat limitations in Otsego Lake have the potential to influence this relationship through limiting natural reproduction on top predators such as northern pike, walleye and northern muskellunge. These top predators are needed to control pan fish and rough fish numbers and allow for better growth and population size structure. They can also manage the white sucker population that has the potential to over populate, limiting food and space available for desired game fish. These top predators will also add diversity to the sport fishing opportunities available. The proposed management action is to stock or provide spawning assistance as follows:

Northern pike: Continue annual spring operation of the rearing marsh. Trap and transfer adult northern pike during the spawning run and transfer them into the marsh to spawn. It is recommended to transfer the majority of the females captured and up to 1.5 times the number of males for each female transferred. Fingerling size should be monitored and release should occur as they reach 1.5 to 2 inch average. If available, spring fingerling northern pike from the hatchery system could also be stocked per guidelines established in the Fisheries Division's stocking guidelines (Dexter and O'Neal, 2004).

Walleye: Continue alternate year spring fingerling walleye stocking at a rate of 50 spring fingerlings per surface acre (50,000 fish total). Walleye fry may be substituted if spring fingerlings are not available. The potential construction of artificial rock spawning reefs to facilitate natural spawning should be investigated to reduce the need for stocking.

Northern muskellunge: Continue every third year fall fingerling northern muskellunge stocking at a rate of four fall fingerlings per surface acre (7,888 fish total). Spring fingerlings may be substituted if fall fingerlings are not available.

Lake Sturgeon: Lake sturgeon have become a popular sport fishery and stocking is needed to maintain a fishable population. Continue a periodic fall fingerling stocking program of 800 fall fingerlings every five years.

4) Fishing regulations: The current fishing regulations appear to be adequate to sustain the fish community while affording angling opportunity and harvest. Northern pike spearing has been recently permitted (winter of 2010-2011), with little participation and associated harvest noted. Periodic monitoring of this activity should be conducted to note any change in participation, harvest or northern pike population.

References

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Serns, S.L. 1982. Relationship of walleye fingerling density and electrofishing catch per effort in northern Wisconsin lakes. North American Journal of Fisheries Management 2:38-44.

Figure 1. Otsego Lake vicinity and hydrographic map.

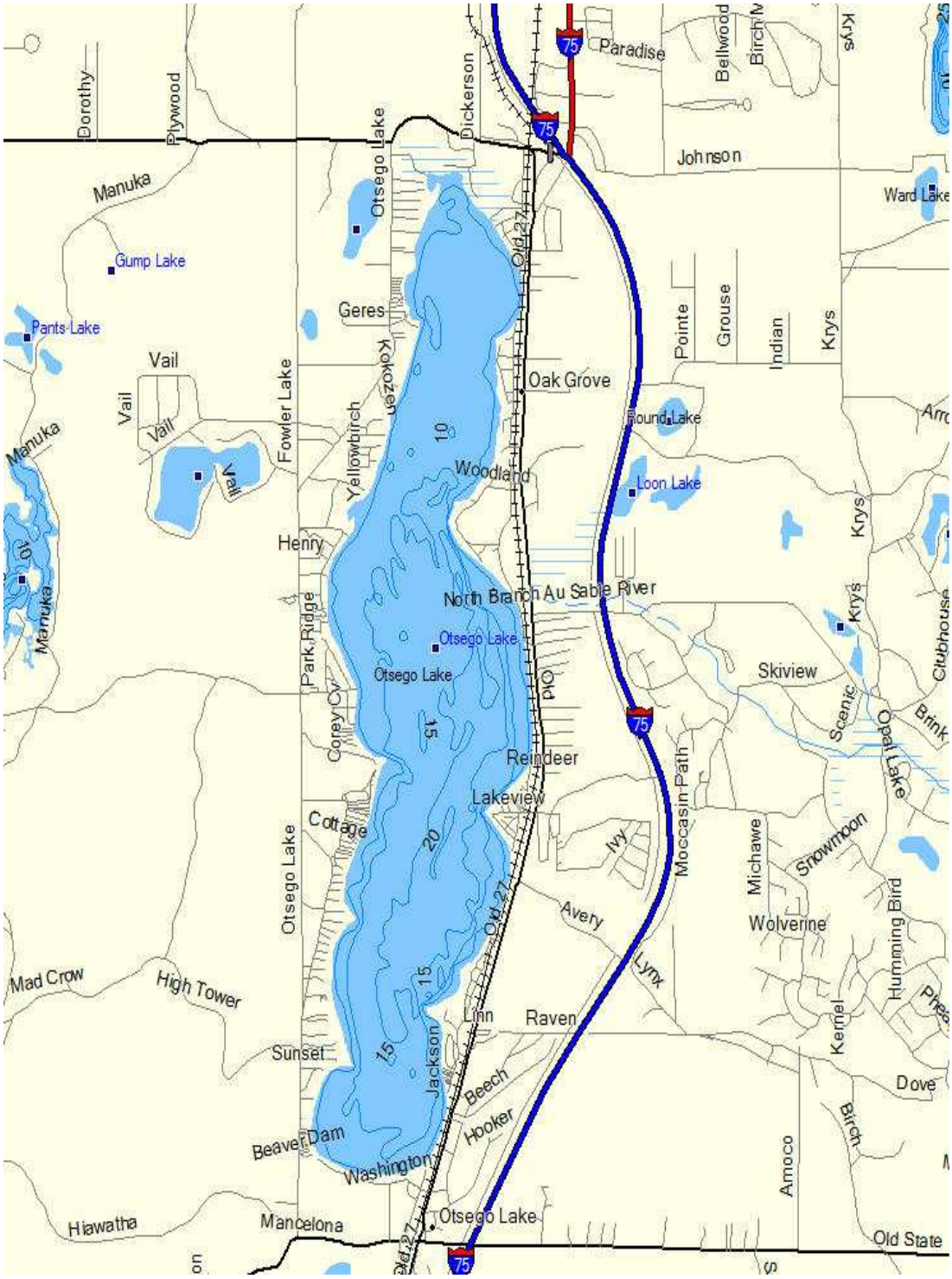

Table 1. Historic stocking records for Otsego Lake.

Year	Smallmouth Bass	Largemouth Bass	Walleye	Yellow Perch	Bluegill	Northern Pike	Tiger Muskellunge	Lake Sturgeon	Northern Muskellunge
1933			600,000 fry	110,000 ff					
1934			800,000 fry	20,000 ff					
1935			600,000 fry	95,000 ff					
1936			810,000 fry	60,000 ff					
1937	915 a	1,000 ff	900,000 fry	20,000 ff	25,000 ff				
1938	837 a	4,000 ff	500,000 fry	32,500 ff	75,000 ff				
1939	306 a		1,000,000 fry	120,000 ff	81,250 ff				
1940	972 a		600,000 fry						
1941	139 a				40,000 ff				
1942	223 a				20,000 ff				
1942	5,000 ff								
1943		2,000 ff			2,500 y				
1944		4,000 ff			27,000 ff				
1945		500 ff			3,000 ff				
1953						100 a			
1954						677 a			
1959						1,223 ff			
1959						262 a			
1960						230 a			
1961						100 a			
1975						375,000 fry			
1975						3,000 sf			
1976							7,312 sf		
1977							8,904 sf		
1979							6,000 sf		
1981						40,000 sf	5,000 ff		
1982						400 sf		235 ff	
1983							6,000 ff	834 ff	
1984						60,000 sf			
1985						90,000 sf	6,993 ff		
1986						100,000 sf			
1987						10,000 sf	6,000 ff		
1988						18,000 sf			
1989						20,000 sf	7,665 ff		
1990						60,000 sf	60,000 sf		
1991			2,000,000 fry			50,000 sf	8,000 ff	7,062 sf	
1992			2,000,000 fry			40,000 sf		2,751 ff	
1992			2,000 y						
1993			1,300,000 fry			51,000 sf		3,996 ff	
1994			36,900 sf			60,000 sf			
1995			5,300,000 fry			30,000 sf			
1996						30,000 sf			
1997			4,000,000 fry						
1998			2,000,000 fry						
1999			43,050 sf			15,000 sf			
1999			28,170 ff						
2000			1,750,000 fry			1,500 sf			
2001						800 sf			
2002			187,113 sf					500 ff	
2002								26 y	
2003			52,426 sf			3,000 sf			
2004			39,200 sf						
2005			16,925 sf						
2006			2,954,100 fry					180 ff	20,431 ff
2008									6,990 ff

(ff = fall fingerling, sp = spring fingerling, y = yearling, a = adult)

Table 2. Fish species captured during various surveys and their relative abundance (A=abundant, C=common, and F=few).

	1949	1958	1959	1962	1969	1978	1980	1981	1983	1991	1994	2001	2007
Gear	GN, S	GN	S	S	TN	TN, GN	TN	TN, FN, GN	TN	BS	TN, GN	TN, GN	TN, FN, GN, BS
Lake Sturgeon										F	F		F
Common Carp													F
Common Shiner	F			A									F
Horneyhead Chub	F												
River Chub	F												
Emerald Shiner													
Blacknose Shiner	C												
Mimic Shiner	F												
Bluntnose Minnow	A												C
White Sucker	C	C	C	A	C	C	C		A	C	A	A	A
Great Redhorse											F		F
Black Bullhead	F	F			F					F			
Yellow Bullhead	F	F			F					F	A		F
Brown Bullhead					F		A		F	F			A
Northern Pike	A	F	F	F	A	F	F	C	C		C	A	C
Tiger Muskellunge						F	F	F	F	F	F	F	
Central Mudminnow	F												
Western Banded Killifish	A												
Rock Bass	C	F	A	C	A	A	C	C	A	C	A	A	A
Pumpkinseed Sunfish	A	C	A	C	A	A	A	C	A	C		F	F
Bluegill	A	F	A	C	A	A	C	C	F	F	C	F	C
Smallmouth Bass	C	F	F	C	C	F	F	A	C	A	C	C	C
Largemouth Bass	A	C	F	F	A	F	A	C	F	F	C	C	F
Black Crappie						C	F	C	F	F	C	C	F
Iowa Darter	F												
Johnny Darter													
Yellow Perch	A	A	A	A	A	C	A	C	C	A	F	A	A
Walleye										A	C	A	A

(GN = Gill Net, TN = Trap Net, FN = Fyke Net, S = Seine, BS = Boom Shock)

Table 3. Length-frequency distribution and average weight of northern pike captured with gill nets, June and July, 1949

Length (in)	Number of Pike	Average Weight (pound-ounces)	Percent of Total Pike in Size Group
13.0 - 13.9	1	0-10	.8
14.0 - 14.9	3	0-12	2.5
15.0 - 15.9	3	0-13	2.5
16.0 - 16.9	0		
17.0 - 17.9	7	1-4	5.8
18.0 - 18.9	7	1-7	5.8
19.0 - 19.9	21	1-11	17.5
20.0 - 20.9	22	1-14	18.3
21.0 - 21.9	10	2-5	8.3
22.0 - 22.9	8	2-10	6.6
23.0 - 23.9	15	2-15	12.5
24.0 - 24.9	7	3-2	5.8
25.0 - 25.9	10	3-11	8.3
26.0 - 26.9	2	4-1	1.6
27.0 - 27.9	2	4-11	1.6
28.0 - 28.9	1	4-15	.8
29.0 - 29.9	0		
30.0 - 30.9	1	5-12	.8

Table 4. Otsego Lake sturgeon harvest through March 9, 2011

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
January		4	5	4	13	8					2	1	1
February			6	19	11	3	1		1			2	6
March			1	10	4	1		1	2	1	1		2
April													
May	1	2											
June				1									
July			2										
August													
September													
October													
November													
December				1	1								
TOTALS	1	6	14	35	29	12	1	1	3	1	3	3	9

Table 5. Young of year fall walleye recruitment surveys

Year	Distance shocked (Mile)	Total YOY captured	Estimated YOY per acre	Stocking year
1991	10.8	161	3.5	Yes
1994	2	40	4.7	Yes
1995	2	42	4.9	Yes
1997	1	30	7.1	Yes
1998	1	49	11.5	Yes
2002	3.9	84	5	Yes
2007	3.86	0	0	No

Table 6. Otsego Lake, Status of the Fishery Survey, 2007

Species	Number	Percent by number	Weight (lb.)	Percent by weight	Length range (in.)	Percent legal size
Black Crappie	5	.3	1.2	.1	7-8	80
Bluegill	87	4.4	21.6	1.3	1-10.8	44
Bluntnose Minnow	124	6.3	1.5	.1	1-3	97
Brown Bullhead	84	4.3	86.6	5.4	7-15.7	99
Carp	1	.1	0.0	0.0	2-2	0
Common Shiner	1	.1	0.0	0.0	2-2	0
White Sucker	350	17.7	819.9	50.9	9-22	98
Emerald Shiner	6	.3	.1	0.0	3-3	0
Greater Redhorse	1	.1	8.6	.5	29-29	0
Johnny Darter	10	.5	0.0	0.0	1-2	40
Largemouth Bass	12	.6	21.1	1.3	3-20.1	33
Northern Pike	29	1.5	127.6	7.9	13-35	72
Pumpkinseed	15	.8	2.7	.2	2-8	27
Rock Bass	325	16.5	133.6	8.3	2-11.5	82
Smallmouth Bass	33	1.7	36.2	2.2	4-18.8	33
Lake Sturgeon	4	.2	22	1.4	28-30	0
Walleye	116	5.9	311.2	19.3	12-26	76
Yellow Perch	750	38	13.5	.8	1-10.9	4
Yellow Bullhead	2	.1	2	.1	12-13	50
All species totals:	**1973**		**1609.5**			

Table 7. Otsego Lake, Status of the Fishery Survey, 2007. Growth Rates

Species/Age	No. Aged	Length range (in.)	State avg. length (in.)	Weighted mean length (in.)	Weighted age freq.	Mean growth index *
Black crappie	0					--
Age II	4	7-8	6.0	7.54	100.00%	0
Bluegill	8.3	4				+2.1
Age II	2	4.8-4.9	3.8	4.85	22.45%	0
Age III	3	7-7.1	5.0	7.03	5.36%	0
Age IV	15	7.5-8.7	5.9	8.12	29.34%	1
Age V	8	8.1-9.5	6.7	8.75	16.33%	1
Age VI	5	9.6-9.9	7.3	9.76	10.20%	1
Age VIII	1	9.8	8.2	9.80	2.04%	0
Age X	7	10-10.8	8.9	10.41	14.29%	1
Largemouth Bass	0					--
Age III	2	10.9-13.4	9.4	12.15	20.00%	0
Age IV	4	12.3-13.2	11.6	12.70	40.00%	0
Age VIII	3	18.1-18.5	17.4	18.30	30.00%	0
Age X	1	20.1	19.3	20.10	10.00%	0
Northern pike	9.9	2				+5
Age II	11	13.2-26.6	17.7	20.89	40.74%	1
Age III	7	22.8-30.5	20.8	27.54	25.93%	1
Age IV	3	26.5-27.6	23.4	26.90	11.11%	0
Age V	2	26.2-31	25.5	27.80	5.56%	0
Age VI	3	27.2-34.5	27.3	30.07	11.11%	0
Age VII	1	31.3	29.3	31.30	1.85%	0
Age XI	1	29.6		29.6	3.70%	0
Pumpkinseed	1.5	1				+1.5
Age II	2	4.5	3.8	4.50	20.00%	0
Age III	1	5.6	4.9	5.60	10.00%	0
Age IV	5	6-8	5.6	7.11	56.67%	1
Age VI	1	7.7	6.6	7.70	13.33%	0

Table 7. Cont.

Rock Bass	7.2	6				+1.2
Age II	13	3.5-4.9	3.9	4.15	5.80%	1
Age III	19	4.6-7.3	5.1	6.03	19.06%	1
Age IV	21	5.8-8.7	6.1	7.57	30.38%	1
Age V	20	7.4-9.3	6.9	8.44	28.07%	1
Age VI	6	9.2-9.9	7.8	9.63	6.37%	1
Age VII	3	9.9-10.1	8.6	9.99	2.54%	0
Age VIII	5	10.2-10.8	9.3	10.52	3.70%	1
Age IX	4	10.5-11	9.8	10.77	2.59%	0
Age X	4	11-11.5		11.38	1.48%	0
Smallmouth Bass	.9	1				+0.9
Age I	1	4.3	3.8	4.30	11.11%	0
Age II	3	9.2-10.5	7.5	9.79	14.81%	0
Age III	9	10.6-12.2	10.8	11.70	33.33%	1
Age IV	2	14.1-14.3	12.6	14.2	7.41%	0
Age V	2	15.2-15.7	14.4	15.45	7.41%	0
Age VI	4	15-17.2	15.3	16.48	14.81%	0
Age VII	1	16.8	16.3	16.80	3.70%	0
Age IX	1	18.6	18.1	18.60	3.70%	0
Age X	1	18.8	18.9	18.80	3.70%	0
Walleye	17.2	8				+2.2
Age I	2	12.8-13.9	7.1	13.35	1.72%	0
Age II	8	12.8-15.9	10.4	14.67	7.09%	1
Age III	25	12-18.8	13.9	14.92	23.12%	1
Age IV	9	15.2-22.3	15.8	19.03	8.69%	1
Age V	14	17.4-22.7	17.6	20.33	13.53%	1
Age VI	10	18.3-24.4	19.2	21.93	11.60%	1
Age VII	10	19.3-26.4	20.6	22.48	11.60%	1
Age VIII	10	20-25.3	21.6	22.71	11.56%	1
Age IX	6	19.4-24.1	22.4	22.65	6.81%	1
Age X	2	20.9-23	23.1	22.00	2.11%	0
Age XI	1	19.9		19.90	0.86%	0
Age XIII	1	21		21.00	1.29%	0
Yellow Perch	-1.1	2				-0.6
Age III	8	5.6-7	6.5	6.17	17.87%	1
Age IV	29	5.8-8.4	7.5	6.69	59.90%	1
Age V	12	7.8-9.7	8.5	8.49	16.67%	0
Age VI	2	9.6-9.7	9.4	9.65	2.78%	0
Age VII	2	9.8-10.9	10.3	10.35	2.78%	0